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ASSEMBLY METHODS for OTTER-TRAWL NETS

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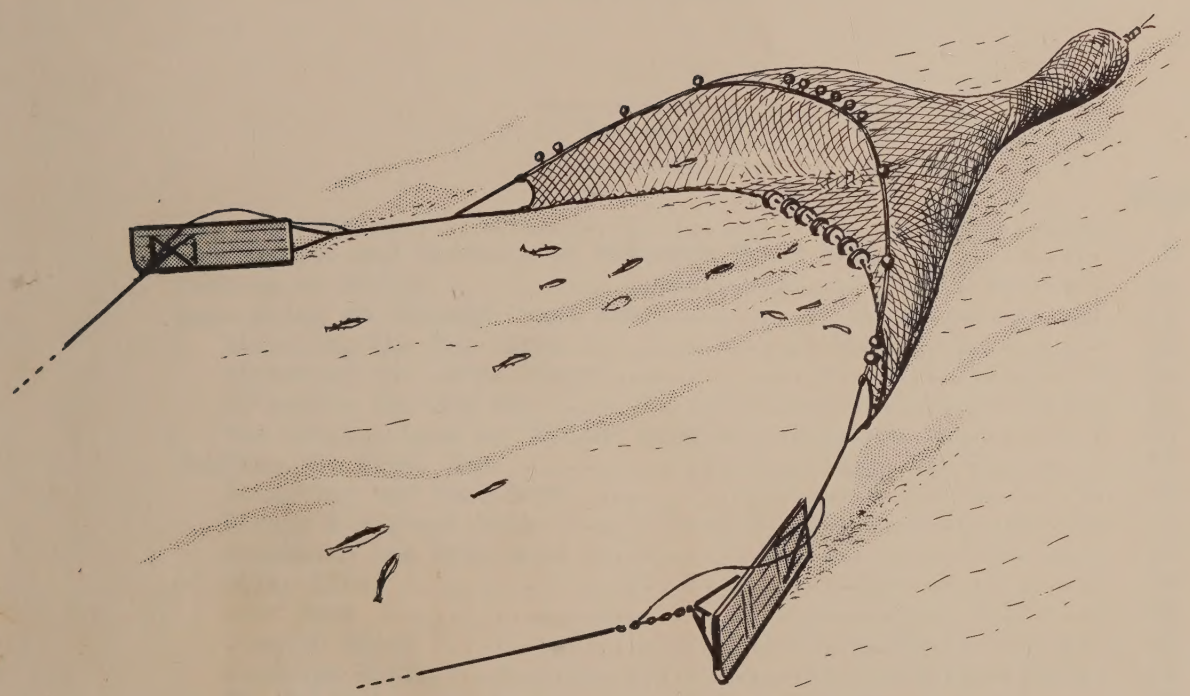

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Fishery Leaflet 437

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ASSEMBLY METHODS FOR OTTER-TRAWL NETS

By Boris O. Knake*

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INTRODUCTION

The otter-trawl net is a device for catching bottom fish. It is constructed of twine webbing so that when fully assembled and rigged it will take the shape of a huge funnel while traveling along the bottom of the ocean (fig. 1).

The proper assembly of the otter trawl is one of the most difficult problems faced by trawler fishermen. Correctly operated, the trawl is an extremely efficient fishing device; when improperly hung or operated, its efficiency is greatly reduced. Gear inefficiency may not be apparent unless trawlers of like size compare catches while fishing in the same areas. Since the trawl is operated at depths precluding visual examination, defects must be determined by a deckside inspection of the net based on a thorough knowledge and understanding of a correctly made and properly hung net.

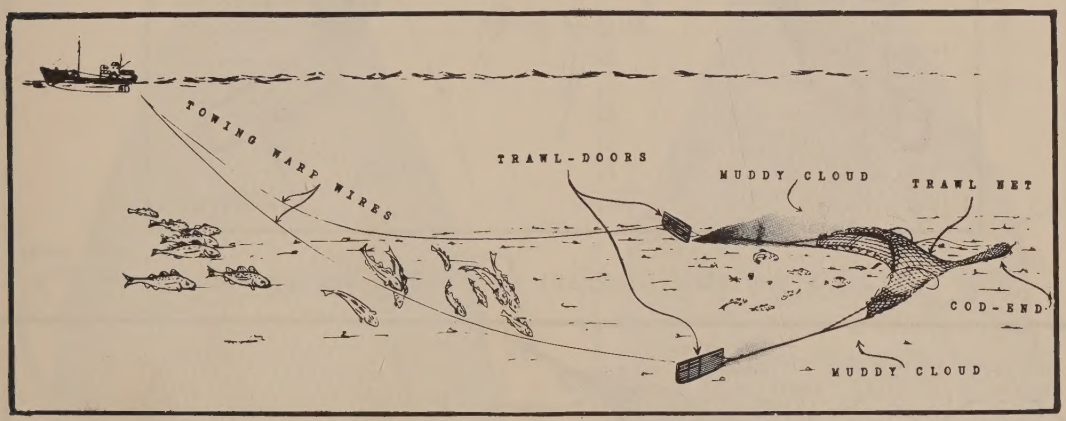


Fig. 1 - Otter Trawl in Action

Efficient fishing performance of the trawl net is contingent upon proper and precise assembly of web sections and net rigging. Correctly rigged, the trawl doors keep the mouth of the net open by operating at an outward angle from the direction of the towed trawl. This angle varies between 30° and 40° (fig. 2).

If a trawl net is improperly assembled, the twine in the net webbing will be subjected to uneven strains. Even or equally distributed strains in the net webbing are necessary to support the loads and withstand the stresses applied to the net. If stresses are unevenly distributed, the individual twine strands, which make up the webbing, will be unduly strained and break - first in one area, then in other areas (fig. 3).

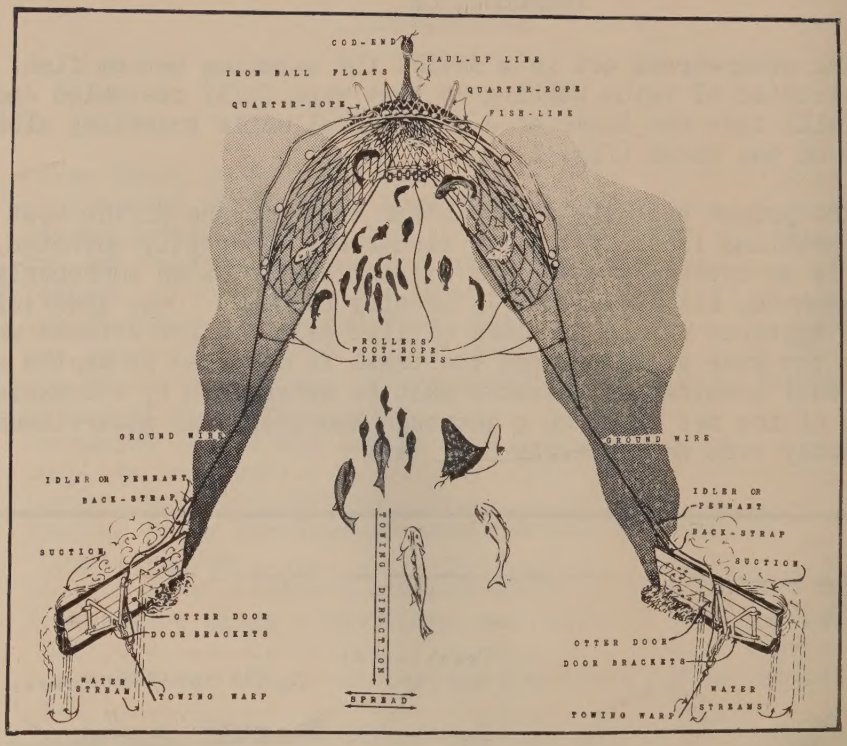


Fig. 2 - Position of Trawl Doors When Towing Net

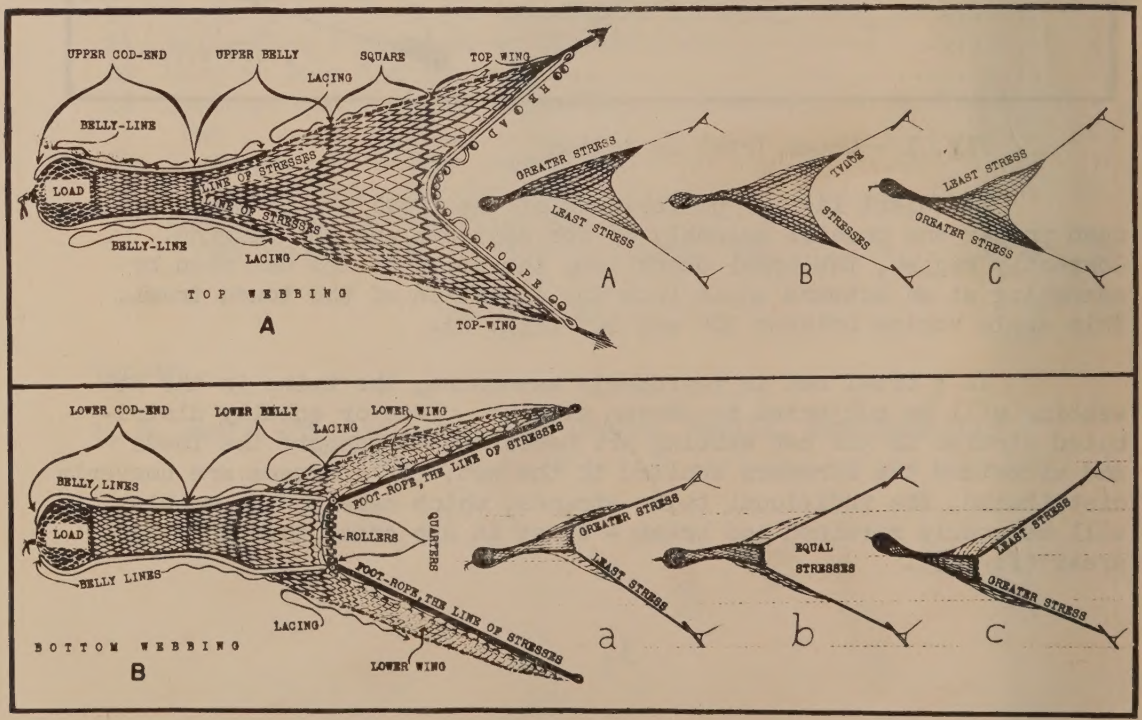


Fig. 3 - Stress Action in Trawl Net

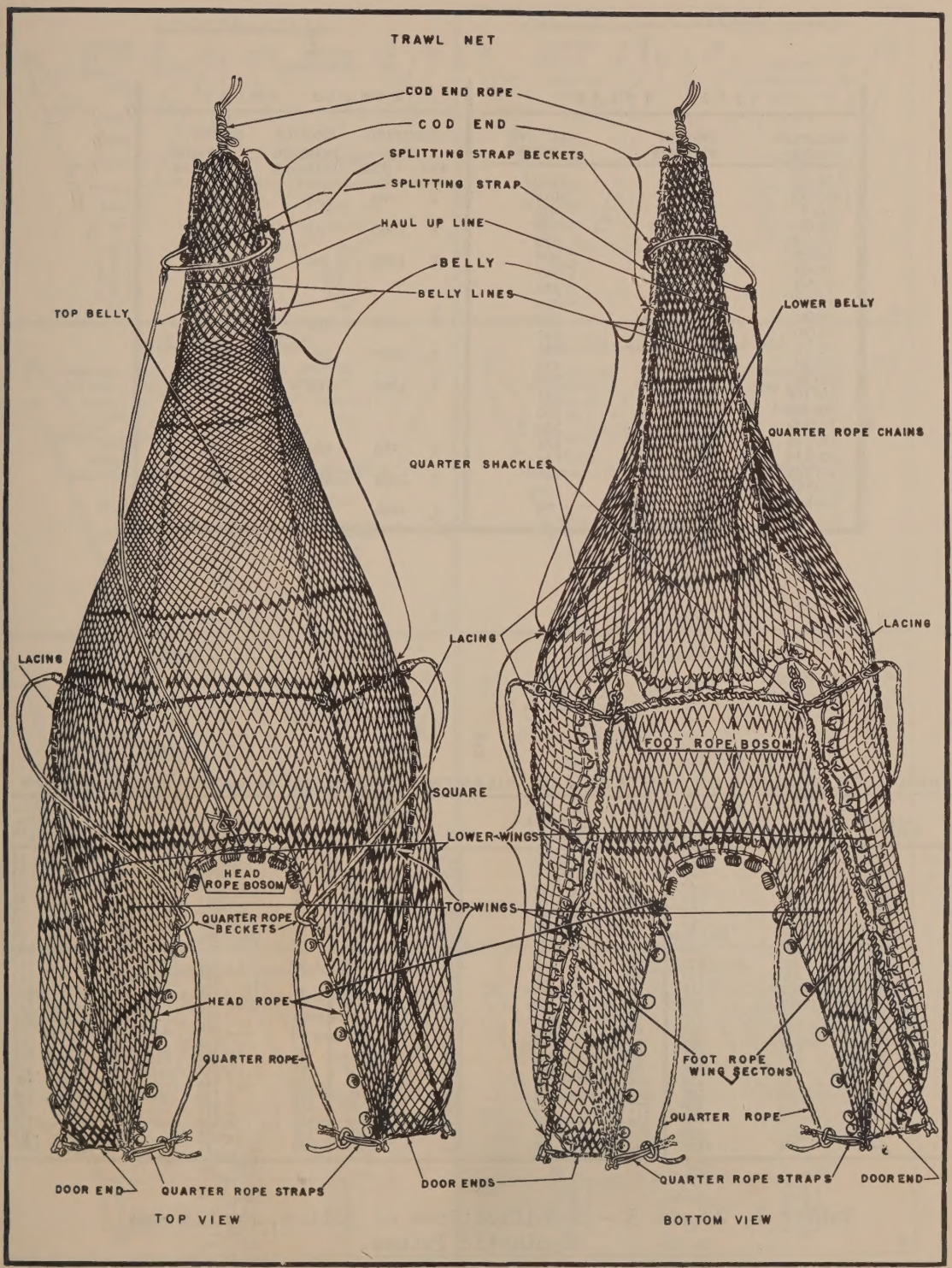


Fig. 4 - Top and Bottom Views of Iceland Otter Trawl

1

COTTON TWINE

SPECIFIED SIZE	TENSILE STRENGTH	FEET PER POUND
10/15	33	1240
10/18	39	1014
10/21	44	870
10/24	50	759
10/27	56	675
10/30	62	609
10/36	74	507
10/42	87	435
10/48	104	400
10/54	120	350
10/60	135	310
10/72	160	252
10/84	195	216
10/96	215	189
10/108	240	168
10/120	260	150
10/132	285	138
10/138	305	132
10/144	320	126
10/156	340	117
10/168	385	108
10/198	435	93

2

MANILA TWINE

SPECIFIED SIZE PLY	- FEET	TENSILE STRENGTH AVERAGE	QUOTED YARDAGE LESS 5%
2	750	143	354
2	1000	95	460
2	1200	84	562
3	750	322	239
3	1000	251	320
3	1200	194	376
4	750	420	179
4	1000	306	236
4	1200	244	282

3

"STABILIZED" SPUN NYLON

No.	Approx. Feet/Lb.	Dia.	Approx. Tensile Strength
6	3720	.032	25
9	2480	.039	36
12	1800	.046	49
15	1350	.052	62
18	1120	.056	73
21	960	.060	86
24	840	.065	97
27	740	.069	108
30	670	.073	121
36	555	.080	144
42	470	.086	168
48	410	.092	192
54	365	.097	216
60	328	.103	244
72	272	.113	288
84	232	.125	337
96	202	.130	386
108	180	.140	434
120	159	.145	590
132	145	.156	630
156	125	.172	715
192	100	.188	870
330	56	.250	1360

"STABILIZED" FILAMENT NYLON

No.	Approx. Feet/Lb.	Dia.	Approx. Tensile Strength
6	3780	.030	44
9	2370	.038	70
12	1710	.045	80
15	1320	.052	110
18	1050	.058	138
21	930	.062	150
24	840	.065	170
27	690	.072	190
30	645	.074	210
36	555	.080	240
42	480	.085	260
48	450	.088	300
54	405	.093	345
60	345	.101	400
72	270	.114	495
84	240	.121	540
96	195	.134	595
108	180	.140	640
120	159	.145	700
132	145	.156	740
156	125	.172	840
192	100	.188	1020
330	56	.250	1600

"STABILIZED" SPUN DACRON

No.	Approx. Feet/Lb.	Dia.	Approx. Tensile Strength
6	2704	.032	24
9	1816	.039	33
12	1348	.046	47
15	1080	.052	58
18	996	.056	71
21	768	.060	82
24	672	.065	95
27	592	.069	107
30	536	.073	116
36	445	.080	141
42	376	.086	164
48	328	.092	177
54	293	.097	201
60	254	.103	233
72	218	.113	268
84	186	.125	298
96	162	.130	336
108	144	.140	400
120	133	.145	596
132	121	.156	630
156	104	.172	715
192	84	.188	875
330	47	.250	1360

Tables 1, 2, and 3 - Specifications of Cotton, Manila and Synthetic Twines.

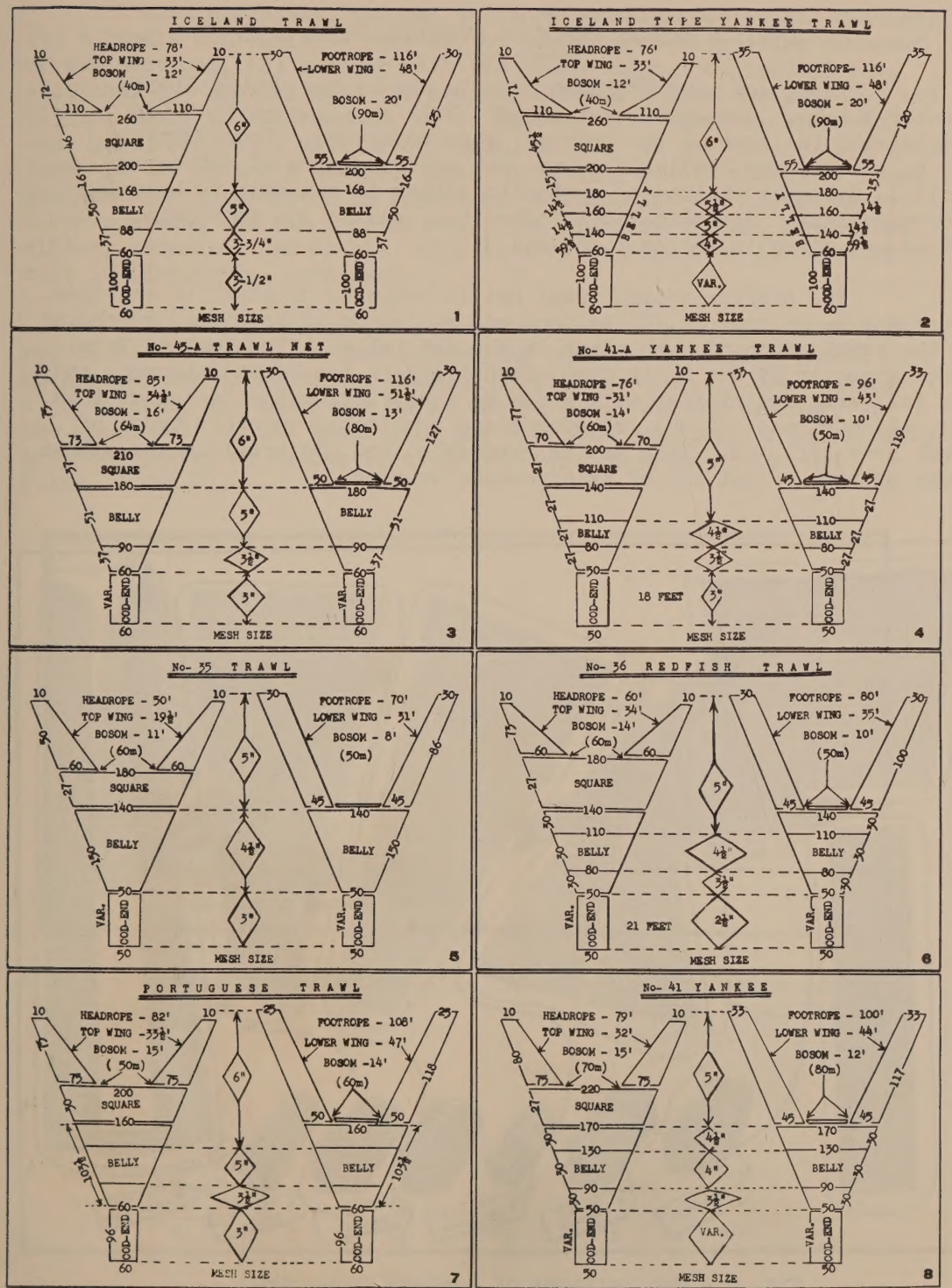


Fig. 5 - Diagrams of Representative Otter Trawls

DESCRIPTION AND ASSEMBLY OF STANDARD TRAWL NETS

There are many standard nets in use by the United States trawler fleets. Commercial net dealers will supply specification charts with the type of net ordered, when requested. These nets may be made of any available twine, but most are made of cotton or manila. Recently the use of synthetic fibers in cod ends is becoming more prevalent. Specifications for cotton, manila and synthetic twines are given in Tables 1, 2, and 3.

The average modern trawl net is composed of about 16 sections. There may be as many as 18 sections and as few as 12 sections, depending on the combination of mesh sizes in the net belly. "The Iceland Trawl Net," shown in figure 4, is used extensively in the North Atlantic, and the following description will refer to construction and design of this net, although most of the procedures are applicable to other types of trawl nets (fig. 5). This net is available from the trawl makers either woven by hand or cut out of machine-made webbing.

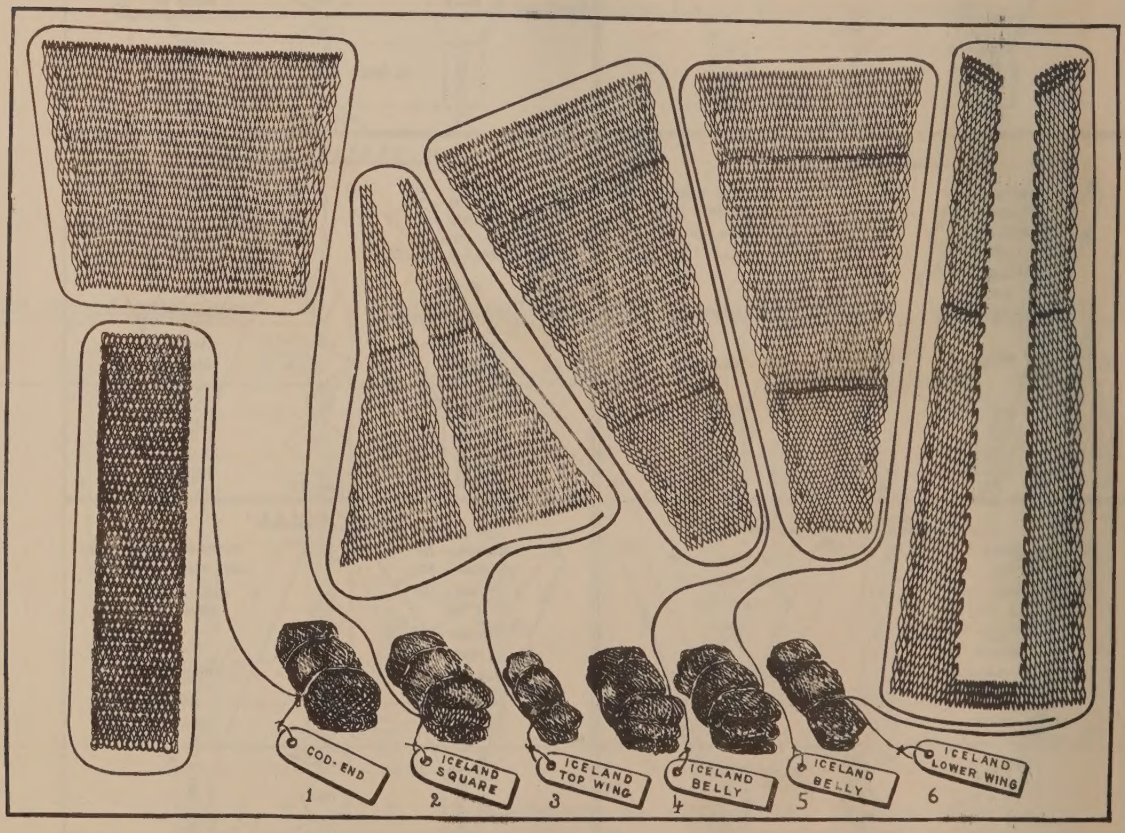


Fig. 6 - Web Sections of Iceland Trawl Net

When purchased, the net sections usually come in six bundles: (1) a bundle containing a pair of top wings, each wing being composed of two sections, (2) another with the lower wings, composed of five sections, (3) another with the square, made up of one section, (4) and (5) the belly in two bundles, or in halves, with three sections in each half, and (6) a pair of cod-ends, usually in one bundle, but sometimes in two separate bundles, each containing a half cod-end. These sections are illustrated in figure 6. All bundles are marked as to their contents and the type of net. The sections of each bundle are already assembled and double twine is used to join them for greater ease in identifying each part.

The net sections are joined together by weaving a half-mesh row of double twine, so that connecting rows can be easily traced when repairing or replacing damaged portions. When all the weaving is completed, the trawl net is in two halves. The top webbing, or the upper half of the trawl net, and the lower webbing, or lower half, are then joined by lacing together the tapered sides of the net (figs. 7 and 8).

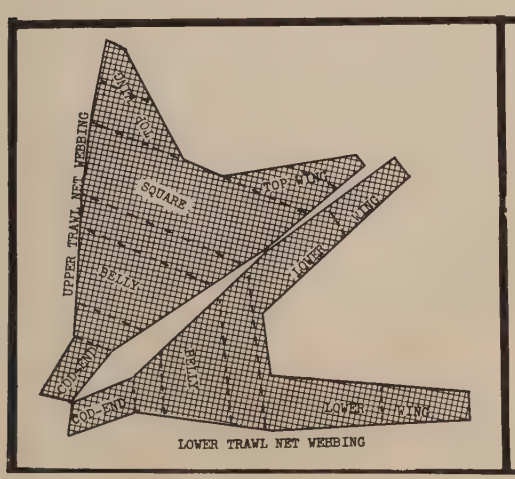


Fig. 7 - Top and Bottom Halves of Iceland Trawl Net.

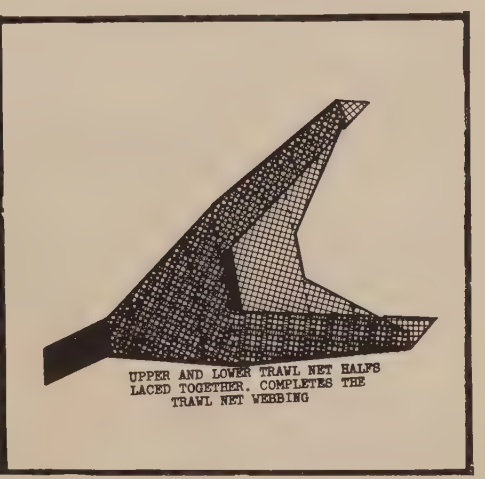
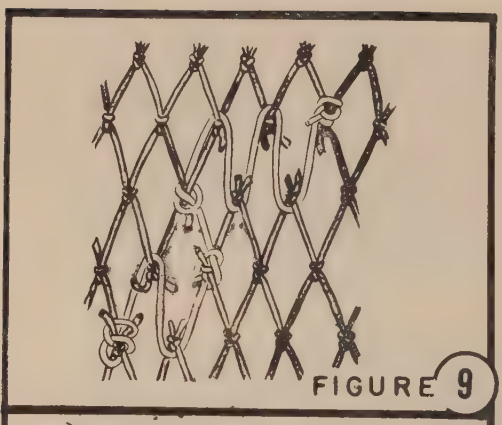
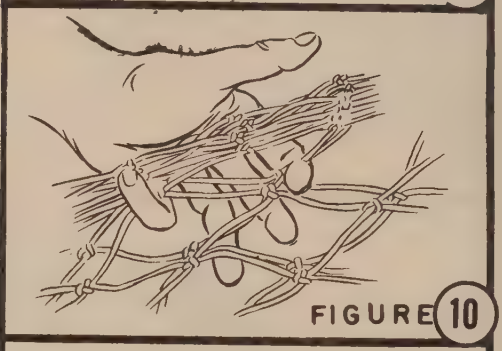
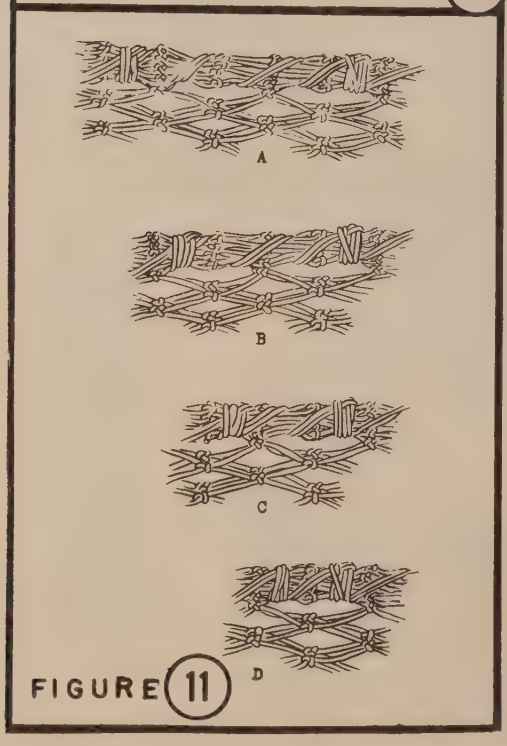


Fig. 8 - Top and Bottom Halves of Iceland Trawl Net Laced Together.







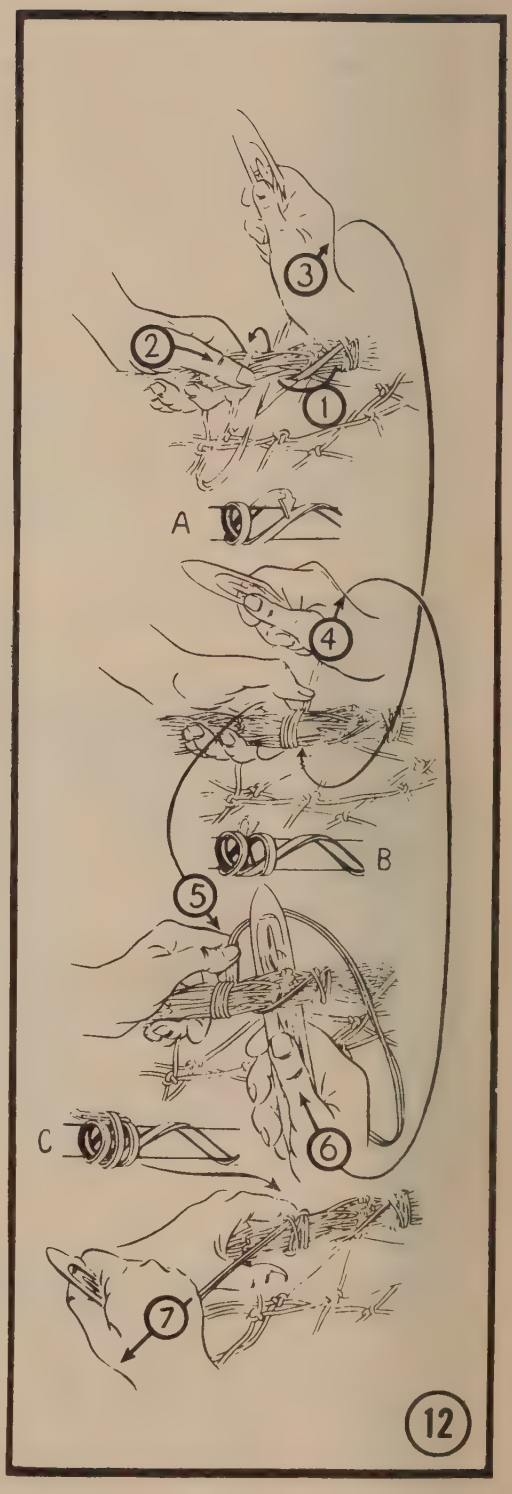


Fig. 9 - Method of Temporary Lacing
10 - Gathering Meshes for Lacing
11 - Completed Laceage

Fig. 12 - Lacing Stop Hitch Method

METHODS OF LACING

"Lacing" is a method of joining two parts of webbing by winding and fastening a twine at intervals with a jam hitch or stop hitch. Two methods of lacing are used. (1) One method is used when temporary repairs are made to the webbing (fig. 9). In this method the twine is reeved loosely through the meshes and stopped by a single square hitch at intervals to prevent binding and slipping. (2) The other method is employed when joining trawl-net halves.

In this second and more permanent method the twine is wound around meshes gathered from the edge of each trawl-net half. This gathering of meshes secured with twine forms a seam called the laceage. The number of meshes gathered depends on how heavy a laceage is required. Generally, 6 to 7 meshes are used but for heavy fishing operations 10 meshes are bunched for the laceage (fig. 10). The lacing twine is wound around the meshes and secured by a jam hitch or stop hitch at various intervals. Hitches are made along the wings on every fourth round; along the square on every third round; along the belly on every third or fourth round, while every round on the cod-end laceage is secured with a stop hitch (fig. 11).

The jam, or stop hitch, is made so it can be easily unfastened by cutting the overlapping strand. The lacing stop hitch is made by holding the round with the left thumb, making the second round by passing the needle under and over the gathering to overlap round one while holding the overlapping point with the left thumb. Proceed with the third round in the same manner. Hold the strand between the left thumb and the forefinger and form a loop, but do not permit the twine to slacken over the meshes. When forming the fourth round, pass the needle under the gathering, through the loop, and tighten twine firmly to complete the operation (fig. 12).

ASSEMBLING AN ICELAND TRAWL NET

When assembling a new trawl net, in limited working space, start by lacing the two belly halves together (fig. 13). To insure an even assembly, check the dimensions of both belly halves before starting to lace them together and fasten temporary seizings along the tapered belly edges at four foot intervals. After joining the belly halves, attach the square section to the top belly half by weaving with double manila twine (fig. 14).

Check the 200 mesh side of the square section and determine the middle mesh by count. Tie the weaving twine into the center mesh of the square and the center mesh of the belly and proceed to weave the square and belly together, working from the middle to the edge. Usually two men do this job, weaving in the opposite direction and

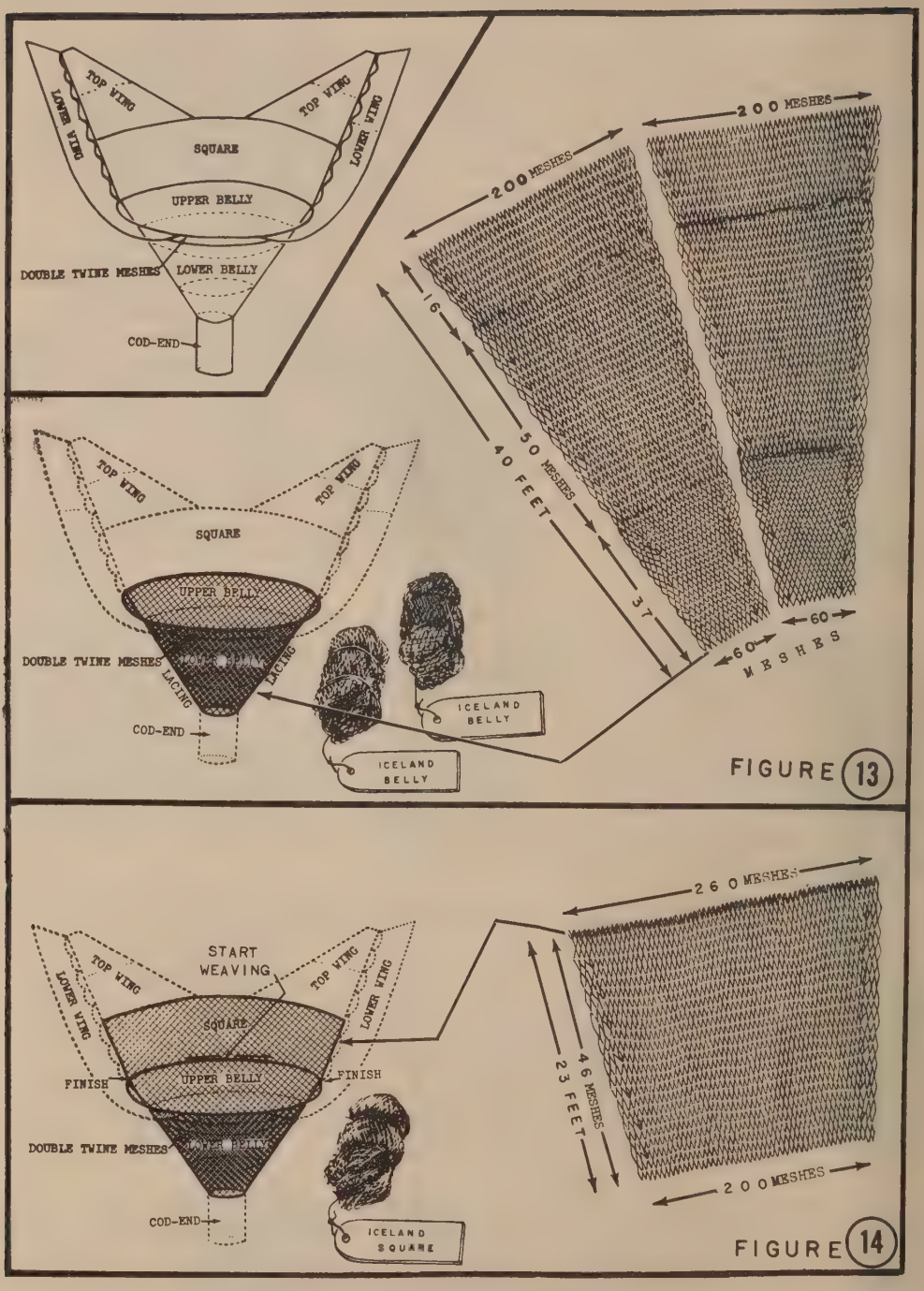


Fig. 13 - Iceland Belly Sections - Dimensions and Position in Completed Net.
14 - Iceland Square - Dimensions and Position in Completed Net.

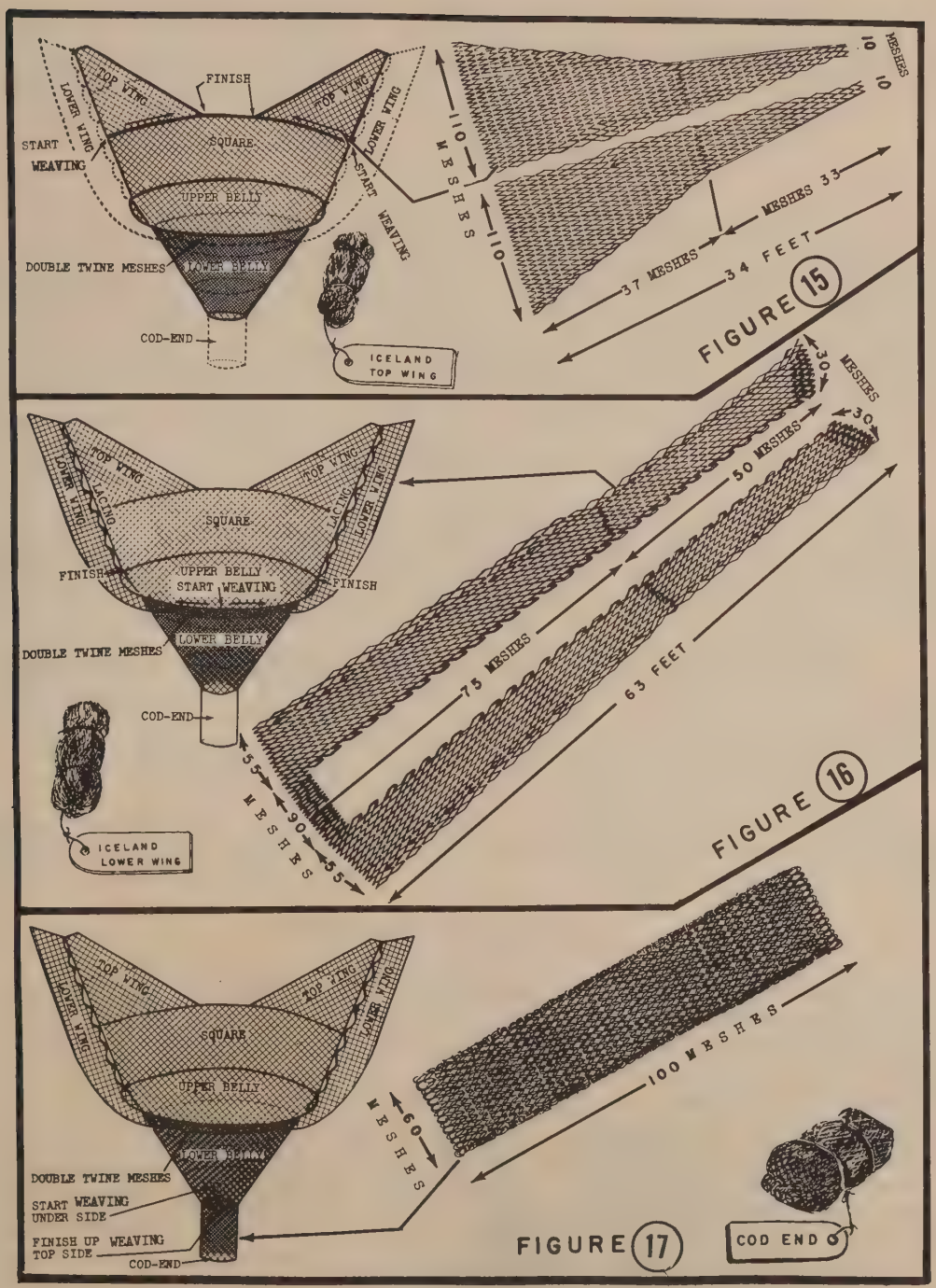


Fig. 15 - Iceland Top Wings - Dimensions and Position in Completed Net.
16 - Iceland Lower Wings - Dimensions and Position in Completed Net.
17 - Iceland Cod-End - Dimensions and Position in Completed Net.

finishing on the tapered edge or laceage. It is customary to check the mesh count before starting the weaving because a section containing fewer or more meshes than stated will cause misalignment of the trawl net.

Attaching the Top Wings

The bundle marked "Top-Wing Iceland" contains two sections. The 110 mesh edge of the top wings is woven into the 260 mesh side of the square, working from the tapered edge towards the middle. This procedure is repeated on the other side (fig. 15). The top-wing should be joined so that there will be 40 meshes of the square net section between the wings which are the top-bosom meshes. The belly half, square and top wings woven together will now be the upper side or top half of the trawl net webbing.

Attaching the Lower Wings

The lower wings are next joined to the lower belly (fig. 16). The pair of lower wings are connected by a double-twine strip of webbing, 90 meshes wide and $1\frac{1}{2}$ meshes deep, which is a portion of the extension required for attaching the wings to the lower belly.

To insure proper centering of the wing, commence weaving the center mesh of the belly half to the center mesh of the double-twine extension strip, working from the middle to the outer edges of the belly half. Laceage is made by lacing the lower wings along the square and top wings edges.

The stretched length of upper net sections, composed of the top wing and square, will be from 6 to 9 feet shorter than the stretched length of the lower wing.

Attaching the Cod-End

The cod-end is usually attached to the trawl net when the net is placed in position at the gallows, since the net at this point is too bulky to handle in the limited working space available on board a trawler. The cod-ends, woven in halves, are laced together at the outer edges, and then attached to the trawl net by weaving one end to the belly of the net webbing. The weaving is started at the center of the underside of both belly and cod-end webbing and working first to the right outer edge and then to the left. The same procedure is followed on the upper side and finally finished with the lacing for complete attachment (fig. 17).

The Hanging Line or "Bolch" Line

The lower webbing is not hung directly to the footrope. It is first attached to a special line known as the hanging line or "bolch" line. This hanging line is usually a rope of 3/4 inch hemp or 12 to 18 thread manila-buoy line, preferably soft-layed and of medium quality. It is generally about 32½ fathoms (195 feet) in length.

When attaching the hanging line to the lower webbing, an allowance of 20 feet of slack rope is left at each end of the wing. This portion of the rope is later used to make up the wing or door ends. The rope should be stretched before using to remove turns and kinks. Allowing for the 20 foot section of slack rope at either end, the center 155-foot section of the hanging line is attached to the lower-net webbing with double-manila twine by forming loops or "bights." The loops are known as the "hanging mesh" and are reefed through the lower-wing fly meshes, and at the bosom section through the double-twine meshes and fastened to the hanging line by a clove or rolling hitch. Proceed as follows in attaching the hanging line; (1) pass the needle through the net meshes over the hanging line; (2) follow up with another turn; (3) pass the needle through the last turn from under; and (4) follow through until the hitch is tightened completely. Next stretch the lower webbing even with the hanging line and fasten the hanging twine onto the rope. Then pick up the two dog-ear meshes and fasten the loop on the hanging line continuing all the way to the other end of the wing (fig. 18).

The hanging meshes should not be less than two-bar spacing when bending the dog-ear meshes and not less than one-bar spacing when bending the section of the lower-belly bosom meshes (fig. 19). It is customary to allow slightly longer spacing because the hanging rope will shrink slightly when wet.

BENDING THE TRAWL NET

To complete the assembly the trawl net must be properly hung and bent onto the supporting frame consisting of the headrope, footrope, belly lines, and finished by securing the wing or door ends.

Attaching the Head Rope

The headrope, attached to the top webbing by securing the top wings and the upper bosom, consists of a combination wire rope about 7/8 inch in diameter and 78 feet long with an eye splice in each end. The new type headrope used in the New England fisheries is made in three equal sections, each 25 feet 10 inches in length (fig. 23A). Each section is provided with an eye splice at either end and the sections are inter-connected by a split link or figure-8 link to form a 78-foot line. The principle advantage of the sectional

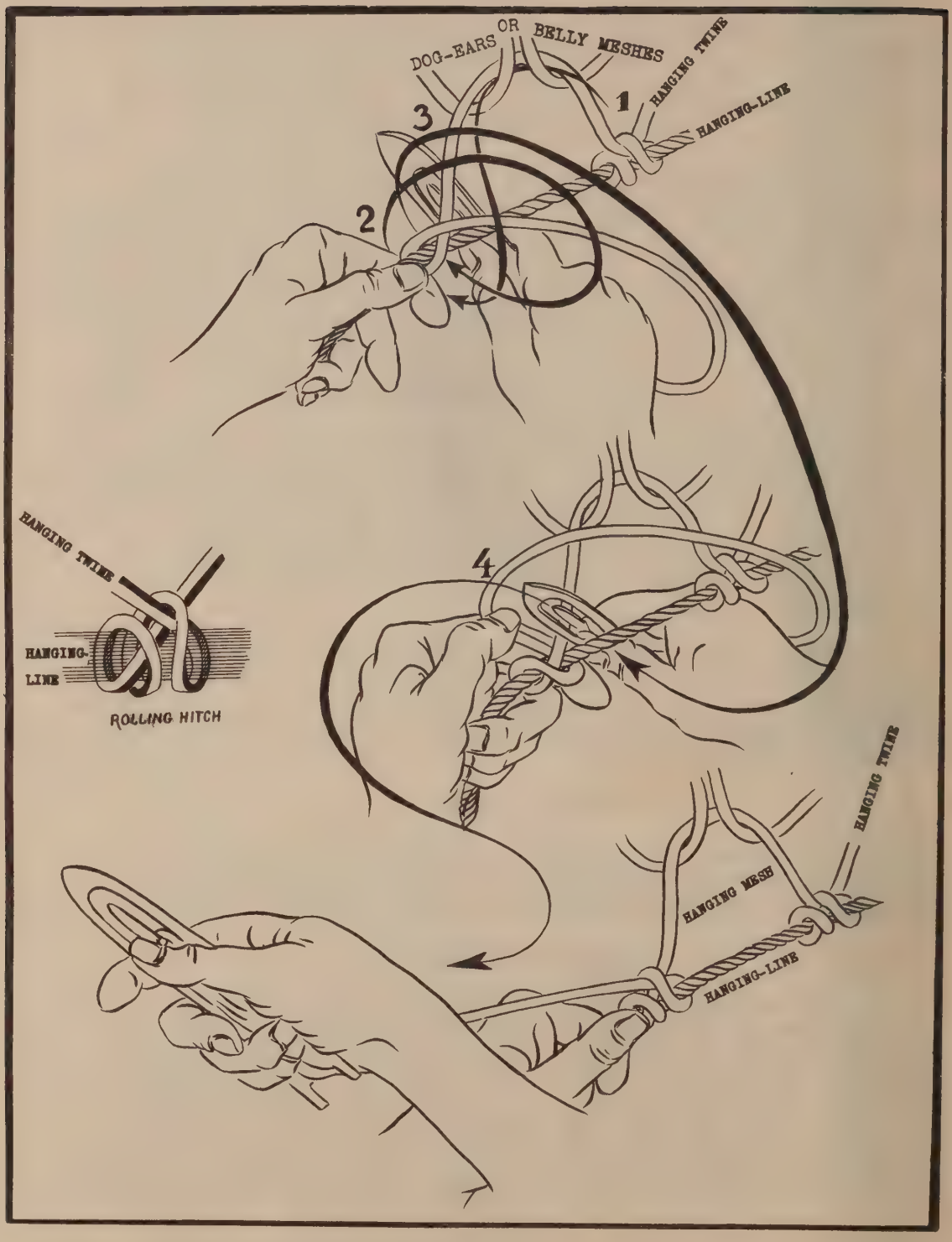


Fig. 18 - Attaching Hanging Meshes to Hanging Line.

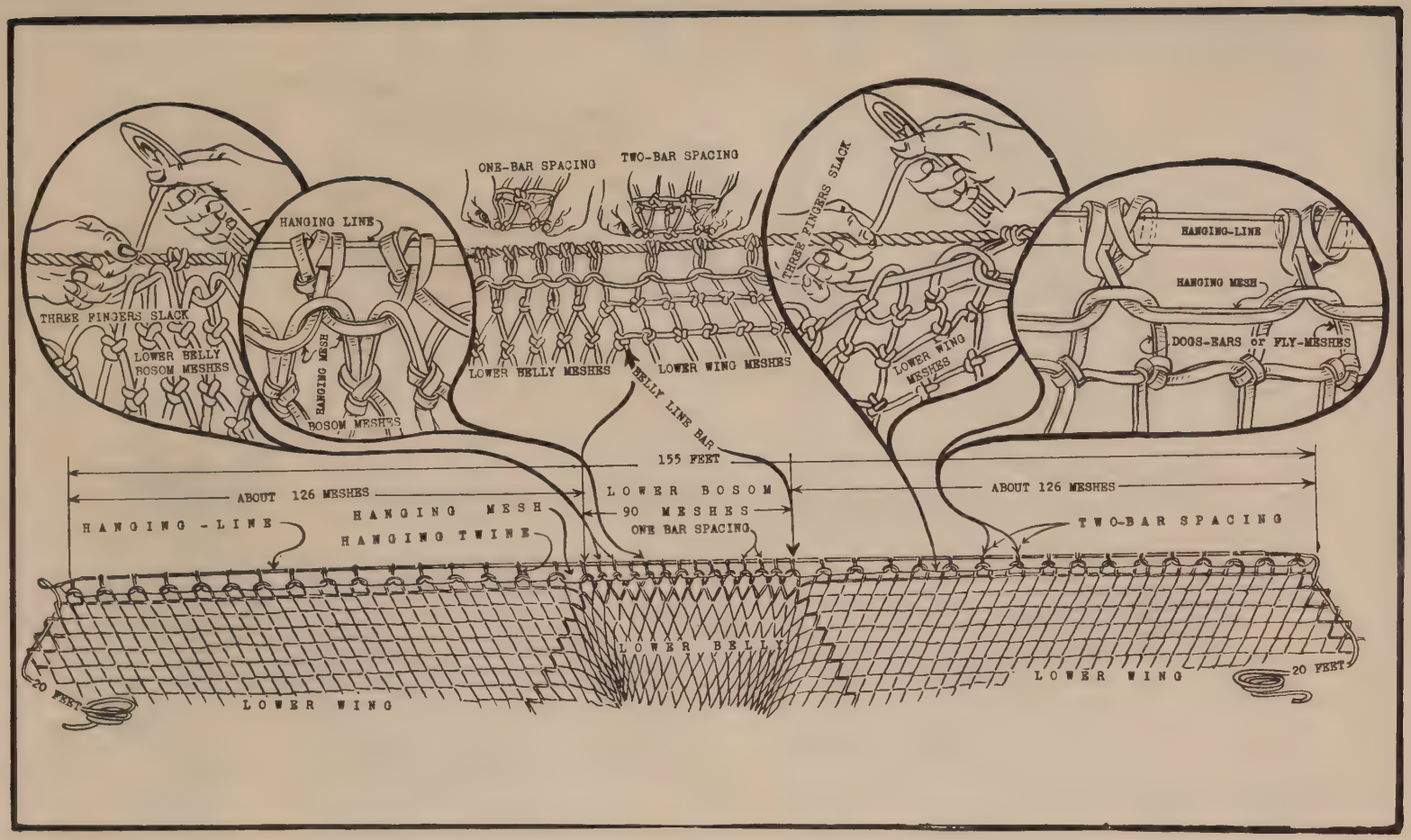


Fig. 19 - Spacing of Hanging Meshes on Hanging Line

headrope is that damaged sections may be renewed without replacement of the entire line.

In attaching the trawl net to the headrope, the full length of the headrope should be stretched on deck and fastened at each end to convenient uprights. Sections 33 feet in length should be measured from each end and a permanent marker, generally a strong seizing, placed at these points. The upper bosom meshes are bent on the 12-foot center section between the two markers. The upper wings are bent on the 33-foot lengths on either side of the bosom section (fig. 20).

The top webbing is placed in position on the headrope, so that the bosom meshes are in the 12-foot center section between the markers. The top-wing end meshes should then be fastened to the end eye splice with all 10 meshes bunched together. When the end seizing is secured, the top-wing selvage is fastened to the headrope by a round hitch. Upon reaching the bosom meshes, the method is similar to the bending of the bosom-hanging line. The 40 meshes of the upper bosom should be evenly bent on the 12-foot space.

When a new top-wing is placed on the headrope, it will probably be slightly longer than the distance from the marker to the end-eye splice. This additional webbing length is allowed for shrinkage when the net is wet.

When bending the top-wing on the headrope, the slack should be gathered proportionately throughout the length of the top-wing area. When bending an Iceland-trawl net of 6 inch mesh size, uniform spacing is obtained by using the left hand fingers as a gauge in measuring the loops of the hanging mesh. The spacing of the bosom mesh is about three fingers as is the allowance of slack to the hanging mesh (fig. 20).

When the headrope attachment is completed, it is followed by making the quarter-rope beckets and lashing on the floats. A piece of rope about 5 feet long and 3 to 3½ inches in circumference is generally used to make the beckets (fig. 20). The center of the becket loop should be 4 feet from the bosom marker on each wing section. The width of the becket loop is about 18 inches. A single half hitch with at least two seizings on each end is the best method of attachment. The span between the center beckets should be equal to the distance between the two quarter shackles on the footrope.

Floats for Trawl Nets

Floats for otter-trawl nets are usually made of glass, steel or aluminum alloy. They measure 6 to 8 inches in diameter for the spherical shape (ball type) and 8 inches in diameter by 14 inches in length for the cylindrical shape (can type) (fig. 20). Each float is

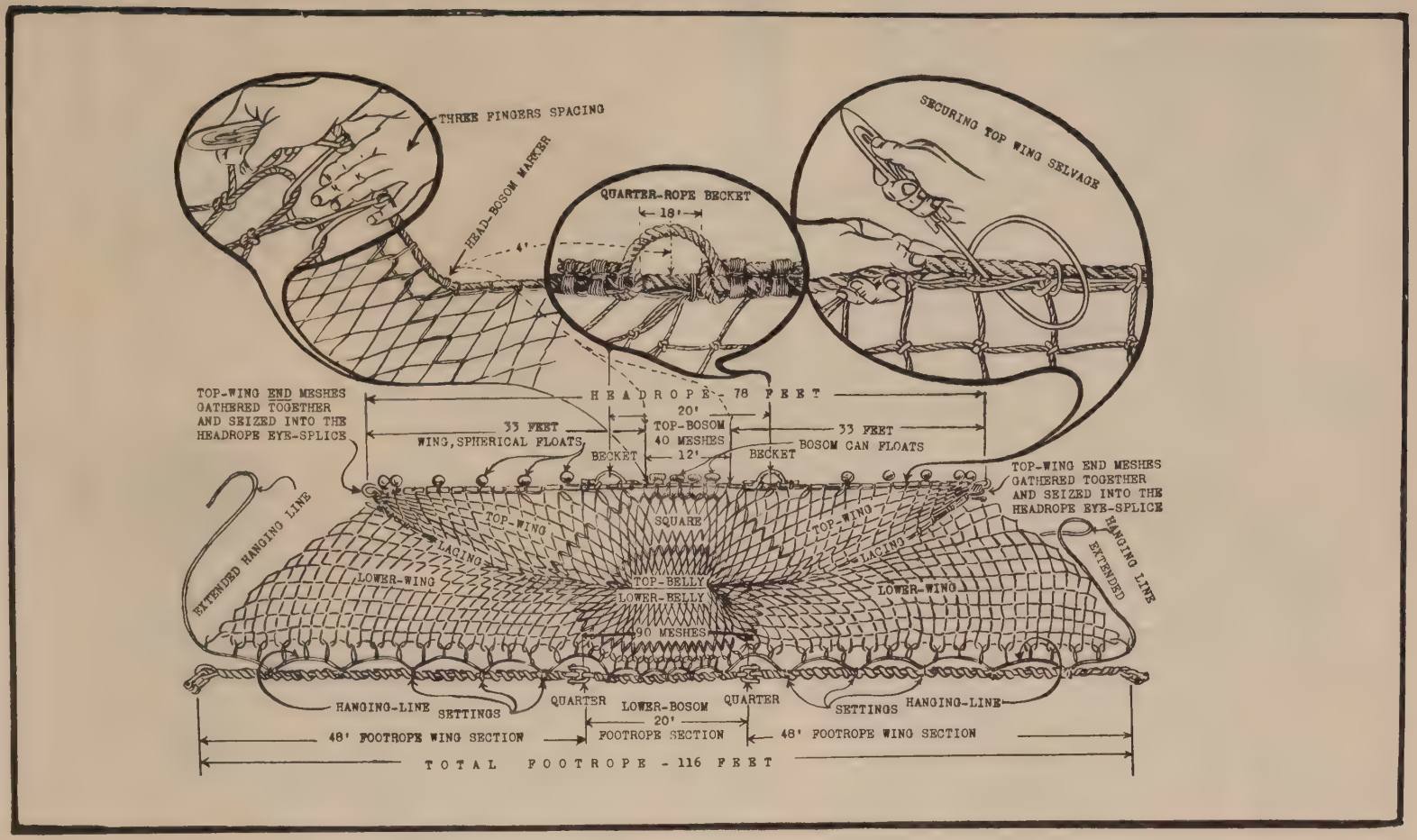


Fig. 20 - Footrope and Headrope Assembly on Iceland Trawl Net

provided with "U" bolts or rings by which it is seized on the headrope. The number of floats on a trawl net varies depending on the size of net and the species of fish wanted. The average number for the Iceland trawl when fishing for cod and haddock is 24. The floats are placed in the following manner: Twelve floats are attached to the headrope between the quarter-rope beckets by reeving a 1-inch rope through the connecting-eye rings. The rope is then fastened by seizings between each float. The floats are individually lashed on each wing at intervals of about 1 fathom. A total of six floats is used on each wing. In addition to increasing the height of the headrope, the floats help to keep the net from fouling when setting and hauling the gear.

Attaching the Foot Rope

Footropes are attached to the trawl webbing by intermediate "seizings" of manila twine to the hanging line. Footropes are made of flexible wire rope 3/4 inch to 1 inch in diameter and comprise three sections when used on Iceland trawls. Each section is wrapped with a 2-inch rope, usually of low quality, known as "rounding" which serves as a protective measure in keeping seizings or "settings" from chafing. Furthermore, it allows smoother clearing of small obstacles found on the bottom of the sea, such as stones and shell.

The combined length of the three sections of footrope is 116 feet. The two wing-footrope sections are 48 feet in length. The bosom-footrope section is 20 feet long including two quarter shackles when connected (figs. 20 and 23B).

In attaching the footrope to the hanging line, first secure the hanging line in the area at the quarter. The junction of the belly-bosom mesh and the lower-wing dog-ear mesh on the hanging line is placed to face the quarter shackle. Allowing about $1\frac{1}{2}$ feet of hanging line on each side, tie the hanging line by setting onto the footrope. Secure the hanging line by a setting from the center of the bights to the center of the footrope length of previous setting, so that it will have only three knots of hanging mesh between each setting. With this method the hanging line will be in uniform loops, or bulging bights, along its entire length. Smaller loops will be in the bosom area because the hanging meshes are closer together (fig. 20).

Belly Lines

Belly lines are ropes extending from the quarter junctions, over the belly meshes to the end of the cod end (fig. 21). These are particularly important to the trawl-net rig since they help support the weight of fish in the cod end. These lines should be properly attached so that they will be neither too slack nor too tight. Belly lines should be made of rope 3 to $3\frac{1}{2}$ inches in circumference and about

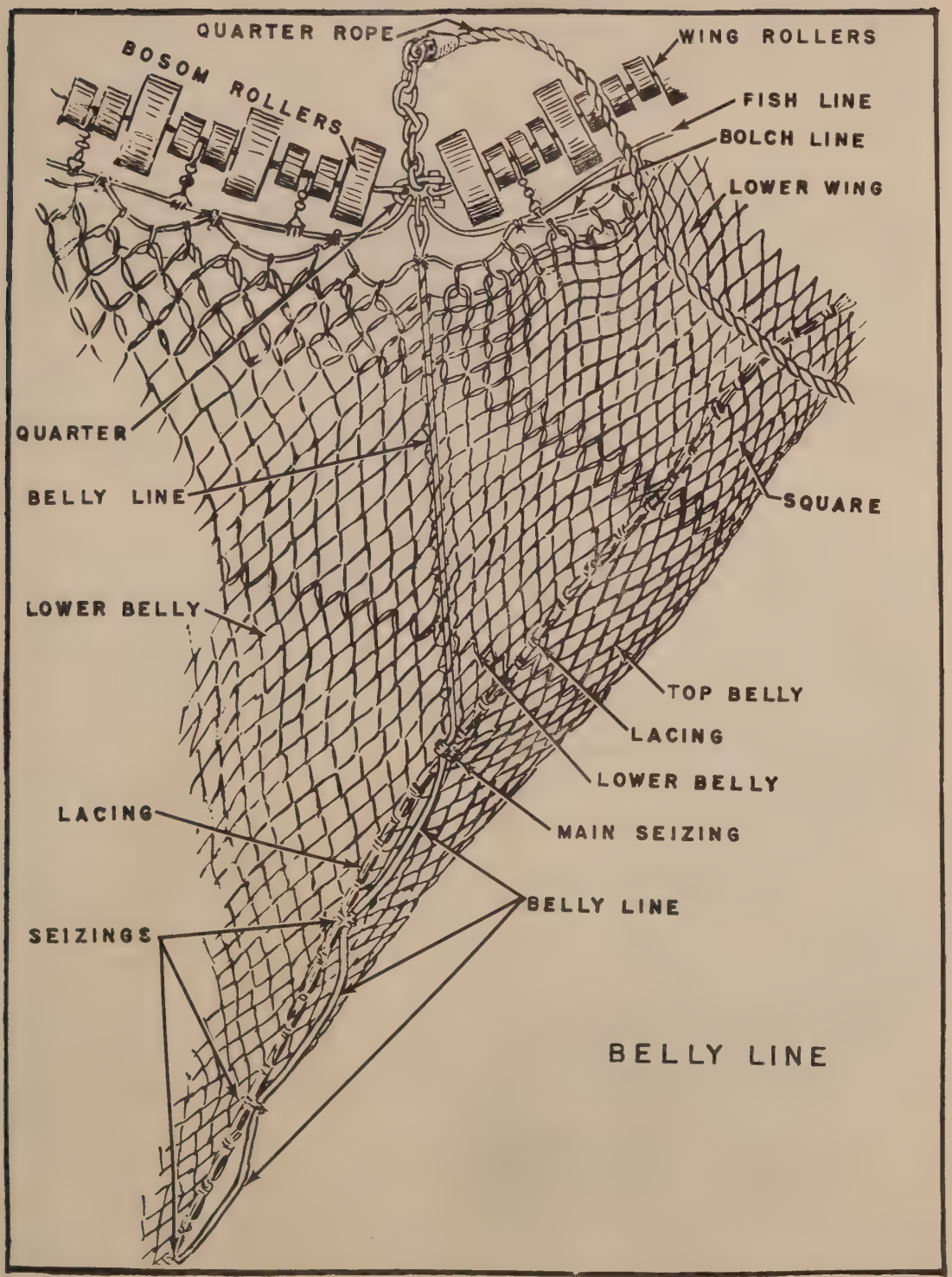


Fig. 21 - Belly Line Attachment at Quarter Junction

65 feet in length. The lines are fastened to the quarter shackle by several chain links and the eye splice of the belly line is made fast by a strong seizing of manila twine. In the eye splice the hanging line is fastened at a point where the belly line will be in line with the first bar of the junction between the belly mesh and the wing dog-ear mesh.

Pick up the same bar and follow along until reaching the laceage. Stretch the bar with the belly line firmly together, then take 2 feet less on the belly line and make a marker. Lay the marker upon the laceage at the point of the measured bar and fasten securely by a double seizing of twine. Then lace the belly bar to the rope so that the slack of the webbing is evenly gathered.

From the laceage seizings the belly line is fastened to the laceage by additional seizings to the end of the cod end. The seizings should be about 3 feet apart. When a new line is bent, the bight between seizings should be about four fingers slack, to allow for shrinkage.

Door Ends

The next step in assembly of the net is to make up the door ends or secure the wing-tip ends (fig. 22). "Door end" is a fisherman's term used to indicate the tip end of the trawl-net wing. It is derived from the time when net-wing ends were secured directly to the trailing edge of the trawl door instead of the present method which employs long bridles or legs and ground lines. The ground wires are held by a figure-8 link at the trawl-door ring stopper. The door end is made upon a stud from a 5/8 inch combination wire rope 6 feet in length with an eye splice in each end. Often a roller chain is spliced in one end and fastened by a shackle or reeved through the eye splice. The chain end is shackled into the foot-rope shackle and the other eye splice is inserted into the head-rope shackle.

To facilitate the work, stretch the stud horizontally and insert the extended hanging line through the chain and eye, and secure it by a half hitch leaving about 1½ to 2 feet slack between the last setting on the footrope and the stud eye. Reeve the end of the hanging line through the individual standing meshes of the lower wing and then through the stud eye at the headrope. It should then be hitched around the eye so that about 8 meshes of the webbing are inside the hitch. Run the remaining line in parallel to the chain eye and back, then lace the stud and the hanging line together distributing the mesh evenly.

Quarter Ropes

Two quarter ropes are used for hauling the net into the boat. These ropes are made of high grade 3 inch or 3½ inch manila rope, about 80 feet in length. A special cup chain is provided for connecting

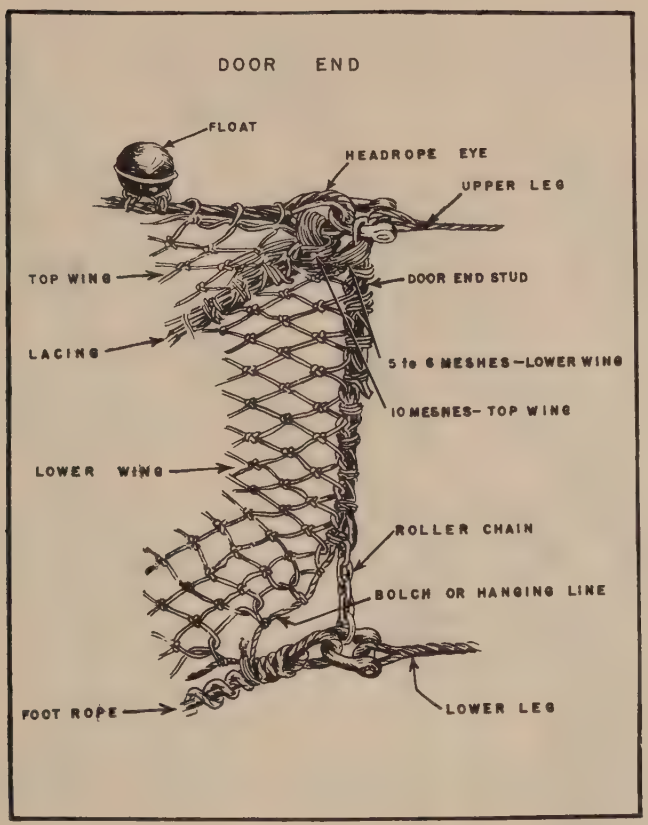


Fig. 22 - Wing or Door End Assembly

the quarter rope to the quarter shackle. The line is fastened to the cup chain by a stopper knot and the rope passes through a becket on the headrope and is tied with a sheet bend hitch to the strap at the door end on the headrope shackle (figs. 21, 23, and 26).

Footrope Rollers

To safeguard the trawl net when fishing on rough ground, the footrope is partially replaced by a string of wooden rollers. These wooden rollers or discs are usually made of maple, birch, or oak. There are two different size rollers to each string, a large roller which measures 18 to 28 inches in diameter and 7 to $7\frac{1}{2}$ inches long with a $2\frac{1}{2}$ inch hole in the center, and a small roller which measures 7 to 8 inches in diameter, 7 to $7\frac{1}{2}$ inches in length, with a $2\frac{1}{2}$ inch hole in the center (fig. 23E).

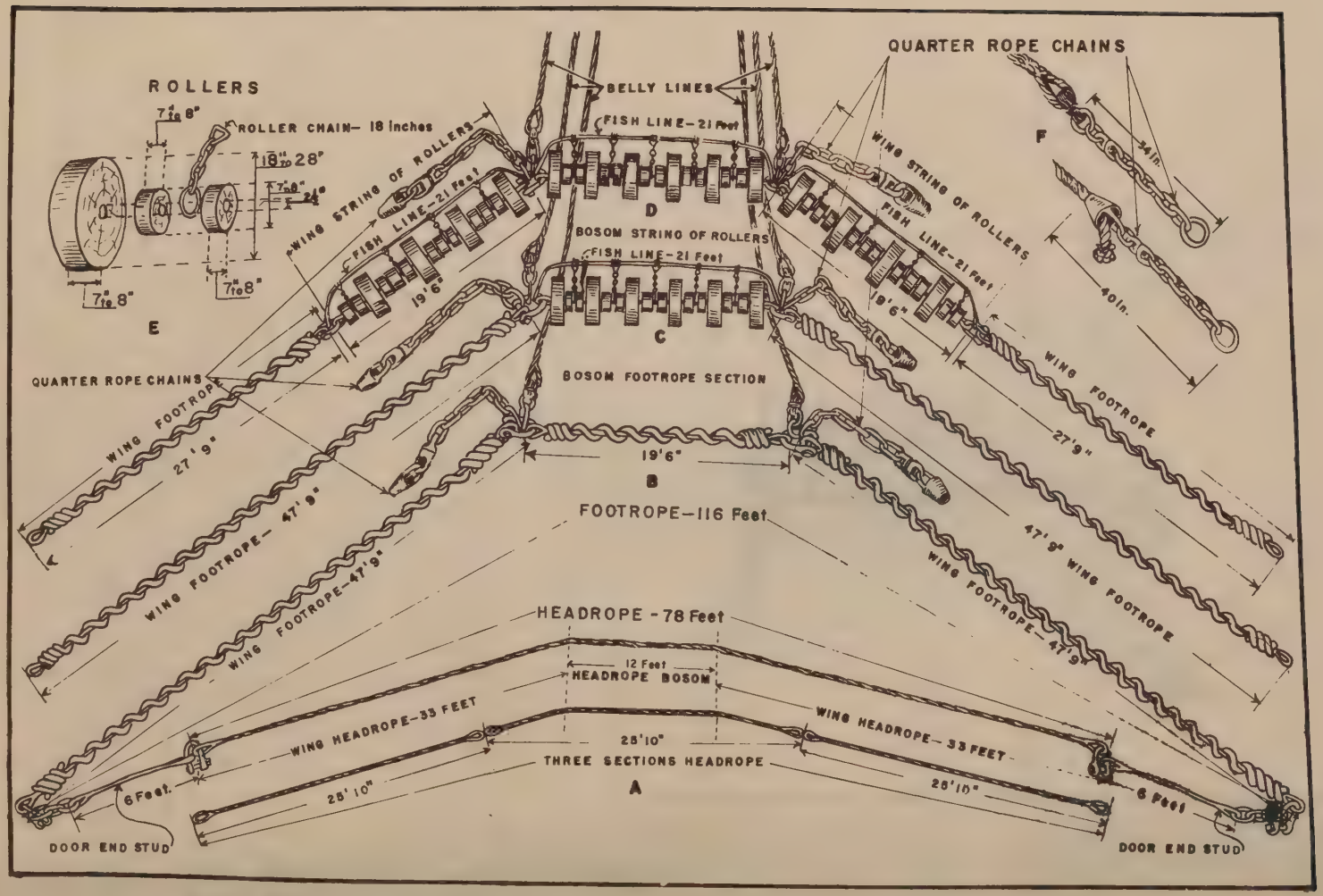


Fig. 23 - Headrope and footrope assemblies in Completed Otter-Trawl Net

The roller wire is usually 7/8 inch wire rope with a length of 19½ feet between the inside of the end eye splice. The roller chains are 20 inches long, one-half inch in size with larger rings 3 inches in diameter at each end.

To install a set of rollers, (1) string all the rollers required on a smaller gauge wire. These are strung in rotation, i.e., one large, one small, a chain, a small, etc., until 10 large rollers and 18 small rollers with nine chains are used. (2) Seize the small gauge wire to one eye splice of the roller wire, (3) flatten the eye splice with a sledge hammer, and (4) cover the seizing with a heavy grease. (5) Brace the first roller on a solid object and heave on the winch to draw the wire through the center hole. Caution: do not forget to insert a stopper at the far end of the roller wire; usually a shackle will serve the purpose.

When all the rollers are strung, insert a spike or shackle in the eye splice of the roller wire before cutting the seizing to prevent the roller from slipping out. When only one string of rollers is used, it is used on the bosom footrope section. The roller string is connected by shackling into the quarters and an additional piece of wire placed over it which is connected into the same quarter shackle. The additional line is known as the fishing line and is usually made of 7/8 inch combination wire and rope. It is about 21 feet in length between the end-eye splices (fig. 23C and D). The hanging line of the net is made fast upon the fishing line in the same manner as the footrope and the roller chains are seized on the fishing line and evenly spaced.

With a trawl rig consisting of three strings of rollers, the method of attachment is as follows: The additional string of rollers is placed from the quarter on each wing and is often strung in rotation. That is, one large and a small roller, then a roller chain and two small rollers. This makes a formation of three small rollers between the large rollers. In all, there should be seven large and 21 small or medium size rollers at each end of the string. There would be one roller chain between the large rollers. Each string of rollers is provided with 21 feet of combination wire and rope sections (fishing line) to which the net wings, hanging line, and roller chain are fastened. The remaining part of the footrope is the conventional type wire rounded footrope 27 feet 9 inches in length. The net hanging line is hung approximately the same as if on a regular footrope with the exception that more slack hanging line is allowed at the junction of the wing-roller shackle and the footrope (fig. 24).

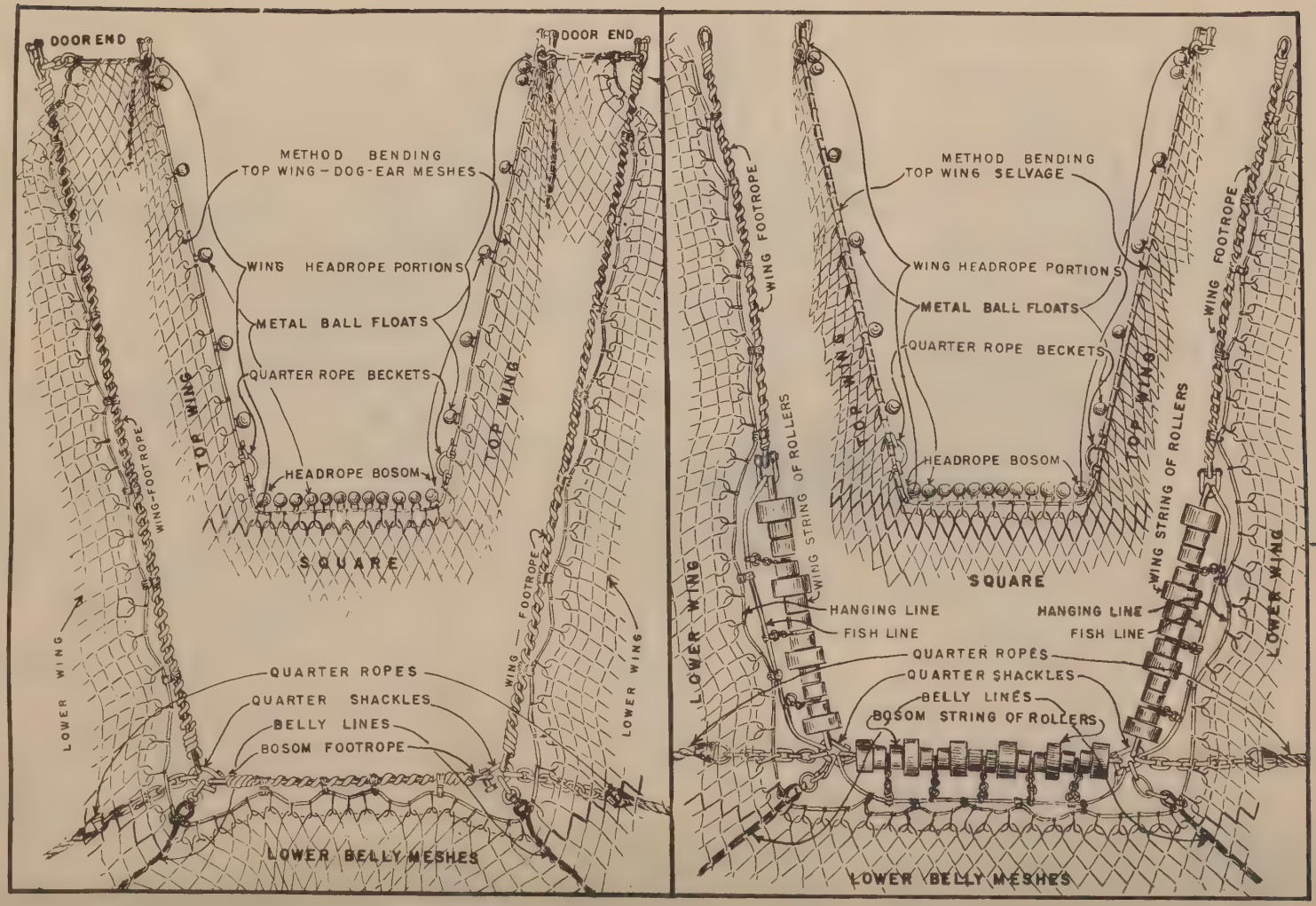


Fig. 24 - Footropes and Roller Assembly

The Splitting Strap

The splitting strap is made of a combination wire about 6 feet long in a partly stretched oval loop. The dimension of the splitting strap will depend on the size of the cod end and the species of fish to be caught. A combination wire is usually spliced into a strap (round). If manila rope is used, one end will be a stopper knot and the other a tight splice so that the stopper knot will not slip through the eye of the splice and the kinks can be taken out by simply twisting the knot.

The splitting strap is fastened about 21 to 35 meshes up from the cod end. This allows up to 4,000 pounds to the lift, depending upon the species of fish in the cod end.

To mount the splitting strap a pair of roller chains is generally used. They are seized on with two double needles making a becket on each side of the cod-end lacing. The rope fastened to the splitting strap for heaving the bag in is known as the "pull rope" or "haul up line." This line is made from a high grade 3 or $3\frac{1}{2}$ inch three-strand rope about 72 feet in length (fig. 4).

The Cod-end Rope

The cod-end is tied by a cod-end rope. This is usually $\frac{1}{2}$ inch, four-strand manila bolt rope $4\frac{1}{2}$ fathoms in length. Ends of the rope are double whipped to prevent fraying. The end meshes or "latches" of the cod-end are made by increasing the loops slightly and doubling by a triple twist. The cod-end rope is reeved through the "latches" so that two whipped ends of the rope project from one side of the laceage and a bight from the opposite laceage (fig. 25-1). Both the rope and the "latches" should be well greased to prevent the rope from binding.

There are numerous ways to tie the cod-end rope. A standard knot used on large otter trawlers is made as shown in figure 25.

Tie the rope as follows: (1) allow a 5-foot bight on the right and two loose ends of approximately 9 feet on the left; (2) make a half hitch in such a manner that the bight overlaps the loose ends; (3) haul it as tight as possible; (4) double the bight end so that about 10 inches of the bight overlaps the square knot and hold so that the double bights are of even length; (5) pass the loose end of the rope over the double bight firmly, and (6) follow up with a second turn (7) under the single bight; (8) make a third turn in the same manner to the left of the second turn, making the second turn tight; (9) make a fourth turn to the right of the first turn over the double bight followed by an additional two or three turns over the double bight and reeve the ends through the double bight loops. Finally, (1) pull the loose ends so that the double bights form a half twist to lock the knot.

There is an alternative method of finishing the knot which is somewhat more easily untied: in step 9, after two or three additional turns have been made over the double bight, continue by bending both ends to form a bight. Insert this bight about halfway into the double bight loops. Pull the single bight on the left side (fig. 25-10) locking the counterpart on the right.

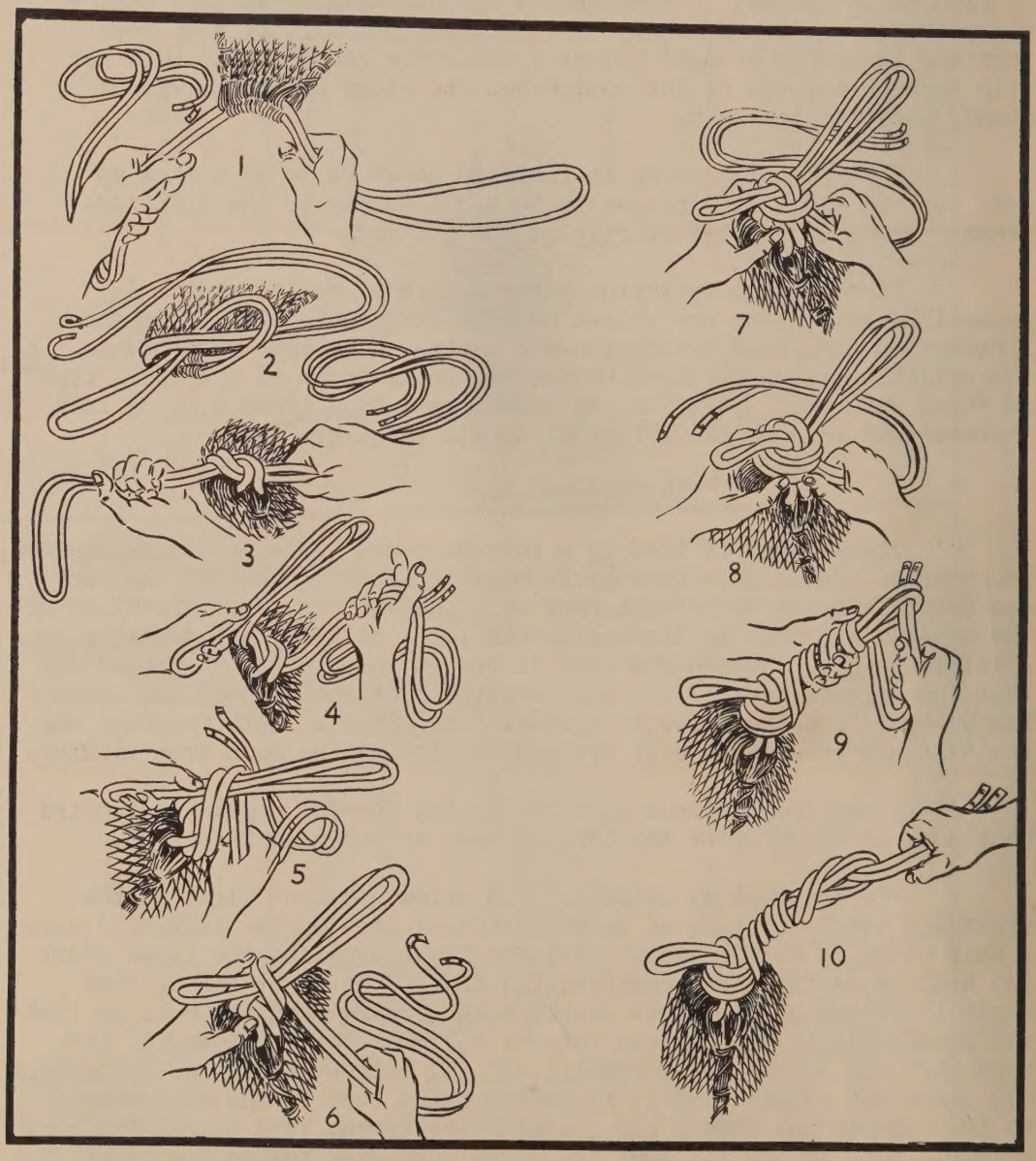
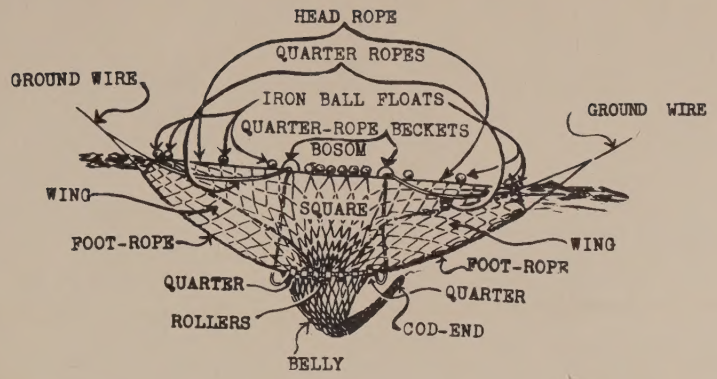


Fig. 25 - Method of Tying Cod-End Knot



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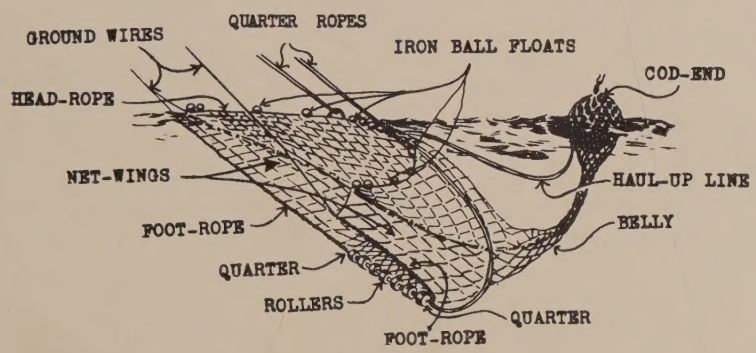

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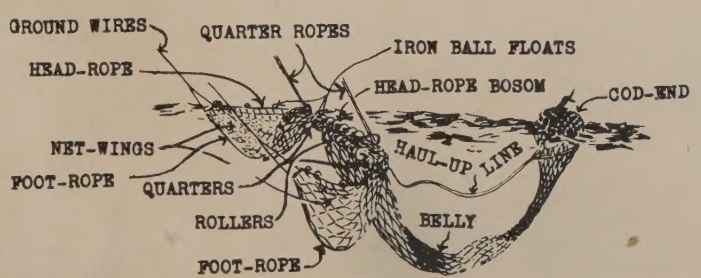

Fig. 26 - Position of Trawl Net on Surface
(a) Setting Net
(b & c) Hauling Net

c

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